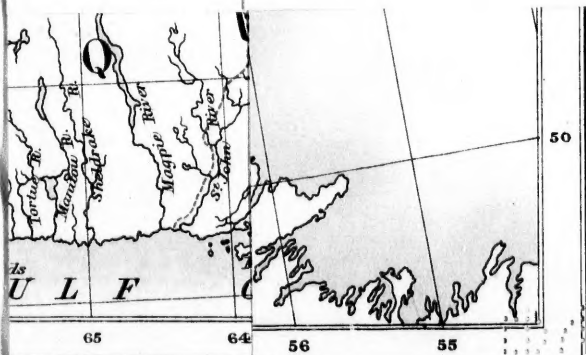


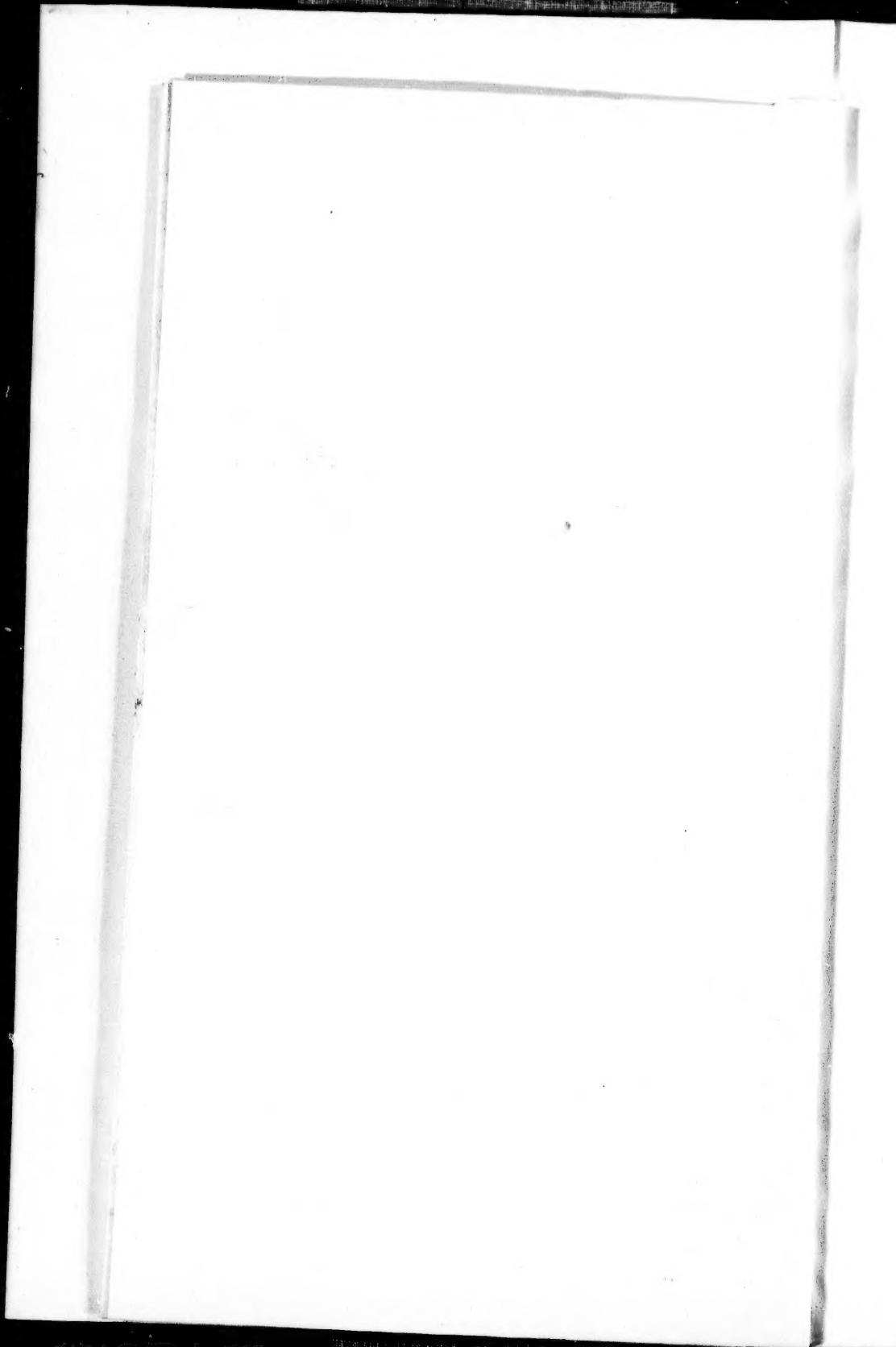
Handwritten notes and a small sketch of a landscape or terrain.

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TO ILLUSTRATE PAPER BY
A. P. LOW, B.Ap.Sc.

SCALE OF MILES
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 Actual Surveys in firm lines
 Information from other sources in dotted lines
 Track of Exploration in dotted red line
 Elevations above sea level marked in blue



EXCERPT FROM THE JOURNAL AND PROCEEDINGS OF
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EXPLORATIONS THROUGH THE INTERIOR OF THE LABRADOR PENINSULA, 1893-1894.*

By A. P. LOW, B.S., Geological Survey of Canada.

THE overland expeditions made in connection with the search for the north-west passage, in the early part of the present century, by Sir John Franklin, have given the public a good idea of the northern portions of America to the westward of Hudson's Bay. This knowledge has been further supplemented by the information obtained by the expeditions sent out in search of Sir John Franklin, under such competent explorers as Sir James Richardson, Admiral Back, and Dr. Rae. The country to the east of Hudson's Bay, embracing the Labrador Peninsula, with an area of 289,000 square miles, owing to the prevalent opinion that it was practically an inaccessible, barren waste, has been slighted by the geographical world, and only within the last few years has any attention been paid to its systematic exploration.

The Hudson's Bay Company have had small posts scattered throughout the interior of Labrador since the commencement of the present century, and the various officers in charge of these posts must have had a good knowledge of the country, which, unfortunately, they rarely made public. The only account of the interior of Labrador, from the pen of a Hudson's Bay Company employé, was that of John McLean, who, being in charge at Ungava Bay, traversed the country between that place and Hamilton Inlet several times between 1839 and 1842. A record of his journeys is printed in his book, entitled, 'Notes of a Twenty-Five Years' Service in the Hudson Bay Territories.'

Until 1870, the Canadian government undertook no explorations beyond the southern watershed. In that and the following year,

* Communicated by permission of the Director of the Geological Survey of Canada. Map, p. 612.

expeditions were organized by the Geological Survey, to explore Lake Mistassini, situated just beyond the southern watershed, and drained by the Rupert river into Hudson's Bay. These explorations were only partly successful, and gave no definite knowledge of the size of the lake. Nothing further was done until 1884, when another expedition was sent to complete the survey of Lake Mistassini; this was accomplished in 1885, and the Rupert river was also surveyed by the writer to its mouth on James Bay.*

The next explorations of the western part of the Labrador Peninsula were made in 1888, when the Big river was ascended 200 miles from its mouth, and a traverse made from there northward to the Great Whale river, which was descended to its mouth; afterwards a survey was carried inland, from Richmond gulf to Clearwater lake.†

In 1887 Mr. Randal Holmes‡ ascended the Hamilton river to Lake Winokapau, where he was obliged to turn back for want of provisions. Two years later, two parties from the United States, incited by the accounts of the Grand Falls, ascended the same river, and succeeded in reaching the falls within a few days of each other.§

In 1892 I received instructions to explore the lower part of the East Main river, with a view to its fitness for a boundary between the province of Quebec and the unorganized territories of the dominion.

The present paper is an account of the continuation of this undertaking in 1893-1894. The exploration of the East Main river was continued upward to its head, and from there the country was traversed northward to Ungava Bay in 1893; and an exploration of the Hamilton river, from its mouth inland to its head, in the centre of Labrador, was made in 1894. Because of the great extent of the country traversed, it is necessary, in such a paper as this, either to deal largely with the incidents of travel at the expense of the principal facts noted, or to devote attention almost wholly to the latter. Although aware of the difficulties inseparable from the last-mentioned treatment, it has been adopted in the following pages, in the hope that the added amount of information which it is thus possible to condense into a given space, may be of greater value than a more readable narrative.

Acting under instructions from Dr. Selwyn, Director of the Geological Survey, and accompanied by Mr. D. I. V. Eaton, as assistant and topographer, I left Ottawa on June 5, 1893, for Lake St. John, at the end of the railway line, 190 miles northward of Quebec, where we commenced our canoe trip. Stops were made on the way, at Montreal and Quebec, to complete outfit. At the former place, through the kindness of Mr. Chipman, Commissioner of the Hudson's Bay Company, I was furnished

* *Report Geol. Surv. Canada*, 1885.

† *Ibid.*, 1888.

‡ *Proc. Royal Geog. Soc.*, April, 1888.

§ *Bul. Amer. Geog. Soc.* 1892; *Bul. Geol. Club*, Philadelphia, 1894.

with circular letters to the officers of the Company's posts in Labrador, enabling me to obtain the necessary information and aid to carry out the work in hand. As it is impossible to obtain provisions or supplies of any kind at the Hudson's Bay posts inland, and as all the able-bodied men belonging to them are away to Hudson's Bay, where they are engaged bringing in the next season's supplies to their posts, a supply of provisions sufficient for the whole trip had to be taken from Lake St. John. To transport these provisions and the outfit, we had two Peterborough canoes, 19 feet long, built of cedar, and each capable of easily floating a load of 1000 lbs. together with a crew of three men; along with these was a smaller cedar canoe and three others of birch bark. Four young Indians were engaged for the entire trip, and eight others to assist in the transport up the rapid streams to Lake Mistassini, some 250 miles away.

Lake St. John was left on June 17, and the Ashuapmucuan river was ascended to its forks, where the Chéf river was followed a few miles to the Sapin Crôche branch, and thence up to its head in File-axe lake, near the height of land. From there a number of small lakes were passed through in crossing the watershed, and the Perch river was descended into the south-east bay of Lake Mistassini, where we arrived on July 2.

The only new exploration along this part of the route was from the forks of the Chéf river to File-axe lake, some 60 miles.

Along the Sapin Crôche the country is over one-half burnt, and is grown up with small black spruce, Banksian pine, aspen poplar, and white birch. Where unburnt the same trees are found, along with larch and balsam spruce. These are generally small, and seldom exceed 12 inches in diameter. The larch are all dead or dying from the ravages of the imported European larch gad-fly, the limit of its depredations now extending northward to the East Main river. The country towards the height of land is traversed by ridges of low rounded hills, with swampy lands and small lakes filling the valleys between.

About the southern part of Lake Mistassini the country is nearly flat, and is covered with a much larger growth of trees than is found in the region between it and Lake St. John. This is probably due to the superiority of the soil about the lake, which overlies bedded limestones; whereas in the rest of the region the soil is sandy drift, resting on gneiss and granite. From Mistassini the eight men with three canoes returned to Lake St. John, as no offer could induce them to go further. In consequence we had to depend on the natives of Mistassini for aid. Two old men and a small boy were found willing to go some distance with us. One of the old men had years ago made a trip to Nichikun, and as he was supposed to still know something of the route, he was engaged as guide to that place. The other old Indian

and boy were hired to take a load to the East Main river; but, as they were too feeble to carry loads on the portages, they were sent back from the outlet of the Rupert river.

At the Hudson's Bay post at Mistassini I was fortunate enough to get a small rough map of the route up the East Main river to Nichikun from a servant, who had formerly been employed at Nichikun. This map was our only guide for some 250 miles, as the old Indian had forgotten the route, and proved utterly useless as a guide. The Hudson's Bay post was left on July 5, with the entire outfit in one bark and three wooden canoes, the former being only used for a few days. From Mistassini to the end of the survey of 1892, on the East Main river, Mr. Eaton, the old man, and myself paddled one of the canoes, the four men being in the other two. Beyond this point to Nichikun Mr. Eaton was engaged making the survey, and consequently was transferred to one of the larger canoes.

From the Hudson's Bay post the lake was followed northward some 50 miles to a small bay on the west side, where a short portage was found leading to the Rupert river, which discharges from the lake some 10 miles to the northward. A short distance below the portage the river separates into two channels, about equal in volume, that do not unite again for upwards of 100 miles. The eastern channel was followed northward 50 miles, to where it passes through a long lake, and there turns westward to join the other channel. The river throughout flows swiftly along in a channel from 100 to 600 yards wide, nearly on a level with the surface of the surrounding country, and is greatly obstructed by small rocky islands. The country passed through is rolling, with low, rounded, rocky hills covered with a scant growth of small black spruce and Banksian pine. The route continues northward from the end of this lake, and for 25 miles passes through small lakes and streams, connected by ten portages, to Clearwater lake. These portages average over half a mile in length, and are all very bad, as they either pass through swamps or over ridges of boulders, where walking with heavy loads is difficult and at times dangerous.

Clearwater lake is an irregular body of water 15 miles long, with numerous bays. Its discharge flows northward through a flat country for 25 miles, and empties into the East Main river, about 300 miles above the mouth of the latter stream. Above the junction the East Main river is one-third of a mile wide, and continues so for 25 miles to the forks of the Tichagami branch, a large stream flowing from the south-east.

Five miles above the forks the survey of 1892 ended; and this point was reached on July 15. A micrometer survey was carried from here up the East Main river, 104 miles, to where the route to Nichikun leaves the main stream, and follows a small branch flowing in from the northward. The general course of the river for this distance is slightly north of east.

The stream is very rough and rapid, with sixteen portages past chutes and rapids, besides a number of places where lightened canoes were tracked up. The valley of the river is shallow, and often the stream flows almost on the level of the surrounding country. The average breadth of the river is 400 yards, and it is often quite shallow. Two large branches flow in on the south side, and one on the north side, together with a number of smaller streams.

Beyond where the Nichikun route turns off the main stream bends sharply to the south for some 20 miles; it then turns north-east, and enters a high range of hills that extend eastwards for over 100 miles. Among the hills the river splits into a number of branches, the discharges of many large lakes in that region. Along the river the country on both sides is low, with rounded hills of granite and gneiss, from 100 to 300 feet high. These hills run in ridges, east and west, parallel to the strike of the rocks. Beyond the sixtieth mile the hills become lower and the valleys wider, and they are occupied by sharp ridges of till, parallel to the direction of the glacial striæ (N. 85° W.).*

Above where the route leaves the river the country continues comparatively flat, towards the south and east, to the base of the mountains some 30 miles away. The trees along the East Main river are small, and do not average more than 8 inches in diameter. Black spruce is most abundant, and is found along with larch, Banksian pine, balsam spruce, and straggling white birch and aspen poplar. The highest hills, where unburnt, are wooded to their summits, and the only barrens are those caused by fire. More than half of the country has been burnt over, leaving only the bare rock or trees of small second growth.

The rocks along the river are all Laurentian in age, and are represented by mica schists and gneisses, along with large masses of hornblende granite.

The glacial striæ are well marked on all rock exposures along the river; their direction is constant, showing the ice-movement to have been from S. 85° E., or towards Hudson's Bay. Boulders in great numbers are scattered indiscriminately over hill and valley, and are often found perched on the very summits of the rocky hills.

The branch by which the Nichikun route leaves the main river is very small, and for 30 miles its general course is from east-north-east. It is then left by a portage route that passes for 25 miles in a north-east direction, through five irregular lakes on various small branches of the river, with portages between, to the height of land between the East Main and the Big river, which also empties into Hudson's Bay. Great trouble was experienced in finding the route through these lakes, as they were marked like a string of beads on the map obtained at Mistassini. The character of the country and trees between the main stream and the watershed is similar to that already described.

* Bearings throughout are all astronomical.

The water in the lakes is remarkably clear and cold, and they are all abundantly stocked with white fish, lake and brook trout, carp, and pike.

At the height of land a portage is made to a lake 5 miles long, which discharges into the Big river. The Big river below this point alternates between lake expansions and narrows. At the narrows, where it has a current of 5 miles an hour, it is quite deep, and is about 200 feet wide. It comes from the southward, where it rises in a number of lakes on the northern slopes of the mountains about 60 miles distant.

Ten miles down the river enters a large lake, and almost immediately passes out again into another lake, and then, by a short rapid, enters Lake Nichikun. The Hudson's Bay post is situated on an island near the entrance of the river, where we arrived on August 4.

The establishment consists of some half-dozen buildings of small logs covered with boards cut with a pit saw, which is also used to make the boards used for the interior finishings. The buildings are each about 12 feet square, and comprise a master's house and kitchen, men's houses, and various storehouses. Only thirteen families of Indians are attached to this post, and, together with the twenty-five families of Mistassini, include all the Indians who trade in the interior. These do not represent half of the Indians that inhabit the interior of Labrador, as the greater number of them prefer to journey with their furs to the coast, where the trade prices are much higher.

Lake Nichikun is about 30 miles long, and in its widest part about 5 miles across. It has a number of deep bays, and its extent cannot be appreciated, on account of the many islands scattered over its surface. The lake is surrounded by granite hills from 300 to 600 feet high, with their higher summits barren.

About Nichikun black spruce is abundant, and the largest trees will square 6 inches for 12 feet. Next in abundance comes larch, followed by balsam spruce. White spruce, Banksian pine, and white birch are not common; and aspen poplar and mountain ash are very rare.

At the Hudson's Bay post a manuscript map was obtained, showing Lake Nichikun and the various rivers and lakes of the northern, western, and southern watersheds of Labrador. This map was made here in 1842 by Thomas Beads and John Spencer, and it proves a valuable addition to the topography of the interior.

Through the kindness of Mr. Jos. Iserhoff, who is in charge of the post, much valuable information was obtained from the Indians concerning the geography and natural history of this region. Nichikun was left on August 7. The outfit was now carried in two cedar and a small bark canoe paddled by two old Indians, who were engaged as guides to Lake Kaniapiskau. This lake lies about 80 miles to the north-east of Lake Nichikun. The route leaves that lake by the middle of its three discharges, and follows down the main stream 25 miles.

It then turns more eastward, and ascends a small branch for 30 miles, passing through a chain of lakes on that stream. Crossing a narrow height of land, a small stream is descended through two small lakes into a large lake; and Kaniapiskau lake is reached by a short portage from the east bay of the last lake, which discharges into the great lake some miles to the northward.

The country between Nichikun and Kaniapiskau is higher and more rocky than any previously passed through, and as the greater part of it is burnt, leaving bare rock thickly strewn with boulders, the region has a very barren, desolate aspect. The tops of the highest granite hills are barren, and the trees in the valleys are small black spruce and larch, with very few straggling white birch.

Lake Kaniapiskau is upwards of 40 miles long from north to south, and is divided into two parts by a narrows close to the base of a barren, cone-shaped hill, from which the lake takes its name. A large stream flows into the south end of the lake, and is said to rise in Fox lake to the southward, out of which a tributary of the Manikugan river also flows southward into the St. Lawrence. The shore-line of Kaniapiskau is very irregular, being deeply indented with bays. Islands are numerous in the southern half, especially along the east side, where the land is comparatively low. There are two outlets to the lake, that join 5 miles below, where the river is a quarter of a mile wide, with a rapid current and shallow channel full of large boulders.

Our guides left us at the discharge, and in consequence the two remaining canoes were very heavily loaded. In running the second rapid of the Kaniapiskau branch of the Koksoak river, a short distance below the lake, one of the canoes struck on a rock and upset. By this accident we lost all our meat except 80 lbs. of rotten bacon, along with many other articles of provision and equipment, and made the remainder of the journey under considerable disadvantage, besides losing a day to repair the canoe and dry the outfit saved.

For 50 miles below Lake Kaniapiskau the river flows north-west. It here has no distinct valley, and runs nearly on the level of the surrounding country, and consists of a succession of lake expansions connected by short rapids, falling over masses of boulders. The surrounding country is low and comparatively flat, with rounded ridges of hills at intervals. Towards the lower end of this course the river begins a long descent, with heavy rapids and small chutes.

Turning abruptly to the east, it enters a narrow valley bounded by almost perpendicular hills of granite, at first about 200 feet high, but rising to 400 or 500 feet, as the river descends in a continuous heavy rapid for over 10 miles, where it varies in width from 100 to 200 yards. The rocky banks are covered with tightly packed boulders, from 30 to 60 feet above low-water mark, showing the height to which

the water and ice rise in the spring. For 20 miles below there is a succession of rapids with smooth water between, where the river widens to half a mile and becomes very shallow. The hills continue to rise, and along the lower part are often 600 or 700 feet high, while the bottom of the valley is fully 200 feet below the general level. The upper parts of the higher hills are barren, and the trees in the valley are very small black spruce and larch. The glacial striae about Kaniapiskau show the ice-movement to have been from S. 20° E., or down the slope towards Ungava bay, and this northern direction was noted in many places along the river below.

Turning now to the northward, the river continues in that direction 50 miles. The surrounding country gradually lowers, until the river is only slightly below its level. Passing a large branch from the south-east called Sandy river, the river falls over a number of granite ledges, and, contracting as it descends, finally falls through a shallow gorge about 50 feet wide and a quarter of a mile long. Two miles below it again contracts, and passes into a crooked cañon about 300 feet deep and 100 feet wide, with overhanging walls. Here in a mile the river falls nearly 350 feet, and at the lower end of the gorge it is over 200 feet below the general level. Below this fall the river for 5 miles is narrow and has a very swift current; but after passing another large tributary, flowing in from the south-east, called Good-wood river, it widens to nearly half a mile, and again becomes a succession of shallow rapids, with short smooth intervals between, for 70 miles. Descending a fall of 80 feet, the river again contracts to about 100 yards, and for nearly 20 miles flows with a strong current in a narrow crooked valley, with perpendicular rocky walls rising in places 1000 feet above the stream.

Issuing from this valley, the river widens out and becomes very shallow for 10 miles, when a large branch from the westward, called Death river, is passed, and the river enters a long lake from 2 to 4 miles wide, surrounded by sharp rugged mountains, often upwards of 1000 feet high. This lake is named Cambrian lake, and is over 25 miles long, and gradually contracts into a river at its lower end, where another large branch, called Ice-dam river, joins from the westward.

On this lake a series of sandstones, limestones, and shales, associated with irruptive rocks, replace the granites and gneisses previously passed through, and which do not again appear along the river to within 75 miles of its mouth. This new series of rocks is remarkable from the great quantities of associated iron ore, in the form of bedded silicious siderite, hæmatite, and magnetite. These ores often occur in great masses, and the exposures noted along the river-shore are estimated to hold millions of tons of iron. These rocks are met with along the river for 120 miles. Five miles below the lake the river falls 60 feet in a long chute. A large branch, called Swampy-bay river, comes in from the

eastward 5 miles below the chute, and is used by the Indians as a route to old Fort Nascaupée, on the head-waters of the Hamilton river.

The river now flows nearly north for 70 miles, to its junction with a very large stream from the westward, named Stillwater river, which, like all its other branches, is yet unsurveyed. Between the Swampy-bay and Stillwater branches, the river flows through a wide valley bounded by sharp hills, and varies in width from a quarter of a mile to two miles, the average being about half a mile. Eight miles above the mouth of Stillwater river there is a narrow gorge, cut out of the shales and limestone, about $2\frac{1}{2}$ miles long, and less than 100 yards wide, through which the river rushes with heavy rapids. The only other obstructions to navigation, between the forks, are two falls of 60 and 80 feet, the former cut out of shales, the latter over broken ledges of flat limestone. Below the Stillwater branch the river widens to over a mile, has a swift current, and is very shallow, with numerous low bars. The valley is considerably wider, and the hills forming its walls run in sharp ridges from north to south. They slope gently towards the east, and have overhanging cliffs facing the opposite direction. Their height gradually lowers as the river is descended, from 800 feet to less than 500 feet, some 30 miles below the junction of the two main branches. At this distance the Laurentian gneisses are again encountered, and the hills continue to lower and spread out, leaving a wide, flat valley, through which the river flows rapidly. It continues quite shallow, and has many large, low islands of sand and shingle, while it varies in width from 2 to 4 miles, with low banks. About 5 miles above Fort Chimo the low rocky hills approach the river, and it is obstructed by several rocky islands, that extend to within 2 miles of the Hudson's Bay post. From there to its mouth, some 20 miles, the stream is from 1 to 2 miles wide, with high rocky banks.

The rise of tide at the mouth of the Koksoak river is about 40 feet, and its influence is felt to a rapid nearly 60 miles inland. Along the lower part of the river, the ebb and flow runs with a current from 6 to 7 miles an hour, and is a source of danger to navigation with any but steam craft. The trees along the middle river are much larger than about its head or mouth. White spruce trees 18 inches in diameter are not uncommon in the river bottom about Cambrian lake, and below it to the last falls. Balsam poplar is also met with along that part of the river, and the black spruce, larch, and white birch are all larger than any noted further up stream. Out of the valley and on the sides of the hills the trees are small, and the summits are barren. The tableland on both sides of the valley is also barren; small black spruce growing only around the lakes and in protected valleys. Below the Stillwater branch the trees again become very small, and the white spruce and birch thin out, leaving only black spruce and larch. About Fort Chimo these last grow only in protected valleys between the

low gneiss hills. The Leaf river, a stream that enters Ungava Bay from the westward, about 20 miles north of the mouth of the Koksoak river, marks the northern limit of trees; beyond that stream, nothing but small willows and Arctic plants are found.

Fort Chimo was reached on August 27, and our canoe trip of over 1200 miles across Labrador was accomplished. Of this distance 450 miles had been previously surveyed, leaving 750 miles for the season's work. Of this 104 miles were surveyed with a Rochon micrometer and large traversing compass, with frequent check observations with a sextant for latitude and variation of magnetic needle. The remainder of the distance was either measured with a Massey boat-log on the lakes, or with time-estimations, by Mr. Eaton, on the rivers. As the direction of this part of the survey was practically north and south, the frequent observations taken for latitude acted as an efficient check on the estimations; and these together afford a fairly accurate survey, as was found when the map was compiled.

The Hudson's Bay Company steamer *Eric* arrived from Churchill three days later, and passage was taken in her for Rigolet, on Hamilton Inlet. Fort Chimo was left on September 10; and George river, a large stream flowing into the south-east corner of Ungava Bay, was reached next day, and ascended some 20 miles to the Hudson's Bay post. This river is about a mile wide, and is bounded on both sides by rugged hills of granite, often 500 feet high, with only a few stunted trees of black spruce growing in low protected valleys. The next stopping-place was Nakvak, on the Atlantic coast. Here the coast is extremely rugged; the mountains of syenite rise in sharp peaks from 2000 to 4000 feet above the sea, and have their upper portions unglaciated.

Davis Inlet, on the same coast, was next visited, where the mountains are much lower, and are glaciated to their summits.

Rigolet, situated at the narrows 40 miles above the mouth of Hamilton Inlet, was reached on October 1. Arrangements were immediately made with Mr. Wilson, of the Hudson's Bay Company, to forward by boat our supplies for the coming year to Northwest river post, near the head of the inlet. We then proceeded in our canoes along the north shore of the inlet, and arrived at our winter quarters on October 13. The Indians were from here sent forward, with instructions to proceed as far up the Hamilton river as possible before the river became frozen over, and then to await until the ice was sufficiently strong to allow them to descend on it. They succeeded in ascending the river 120 miles, and returned to the post on December 30.

Mr. Eaton and myself remained during November and December at Northwest river, where Mr. Cotter kindly shared his bachelor quarters with us, and where we passed a pleasant and comfortable time, working up the surveys and notes of the past season. Late in December

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I made a trip to Rigolet, with a dog-team, in search of men to assist in hauling loads of provisions inland, and returned with eight men on January 15. Four days later, under the command of Mr. Eaton, a party of seventeen men started inland, each hauling on a long narrow toboggan 200 lbs. of provisions, together with a share of the necessary camp outfit. The shortness of the daylight and the extreme cold rendered work at this season very difficult. Notwithstanding these drawbacks, Mr. Eaton succeeded in reaching the foot of the Gull rapids, 70 miles above the mouth of the river. Further progress was barred by the rough ice in the rapids, as yet not well covered by the small quantity of snow fallen. The provisions were safely stored here in a cache of logs, and the party returned to Northwest river, after an absence of twenty days.

While Mr. Eaton was away, I accompanied Mr. Wilson to Rigolet; and from there to Cartwright, located on Sandwich Bay, about 80 miles to the southward; and returned to Northwest river early in February.

Owing to the lack of snow, the final start inland was not made until March 6, when, assisted by extra men, making a total of sixteen persons, we again left, each man hauling a load of 200 lbs. on a small sled 7 feet long, and shod with hoop-iron. Mr. Cotter accompanied us with his dog-team as far as Gull rapids, and materially assisted in the transport.

Above the cache considerable difficulty was encountered in passing the heavy masses of ice, that filled the river from shore to shore for nearly 10 miles. Beyond this the travelling was very good to within 20 miles of Lake Winokapau, where the valley narrows, and the current is so rapid that the stream never freezes over.

Slow progress was made along the narrow sloping margin of ice near the water's edge for 10 miles, until further travel with sleds became impossible. The loads were stored in another cache here, and the party returned to the lower one, for the remainder of the provisions left there.* On the way up, the canoes were taken out of winter quarters about 10 miles below the upper cache, and drawn on sleds to that point. The provisions, outfit, and sleds were loaded into the canoes, and they were then poled and tracked up the remaining 10 miles to the lake. This proved a disagreeable and dangerous undertaking, as the temperature of the air was from 5° to 10° below zero, and the river was full of anchor ice. The men, working in the canoes, were able to grip the ice-covered poles only with their bare hands, and were all more or less frost-bitten.

Lake Winokapau was reached on March 30; and it was then decided to discharge the extra men, and to depend upon the permanent party of six to continue the transportation. The loads were increased to between 300 and 400 lbs.; but such was the quantity of provisions and outfit,

that at first four, and subsequently three loads each were necessary to move it.

The mode of travel until May 19 was as follows: from camp a load would be taken ahead from 12 to 15 miles, and there secured on the bank of the river, after which the party would return to camp. Another load would be brought forward to the same place next day; and so on, until the load containing the camp equipment only remained, when a move ahead would be made, and the camp established some 12 or 15 miles above the provisions. These would be brought to the camp and then transported ahead in the same manner. These trips backward and forward, together with those below Lake Winokapau, made a total of over 1200 miles' travel on foot, more than half of which was accomplished while hauling loads. Mr. Eaton and myself, besides assisting in the transport, carried a micrometer survey upwards from the mouth of the river to the Grand falls.

Hamilton Inlet is the largest of the many long, narrow bays or fiords that indent the Atlantic coast of Labrador. Its greatest length is slightly over 150 miles from east-north-east to west-south-west, and its average width is 12 miles. Forty miles from its mouth it narrows to less than 2 miles, and divides into two bays, of which the southern is the longest. The narrows is about 6 miles long, and above the bay again widens out, and varies from 4 to 16 miles. The country surrounding the inlet is high and rocky, especially along the south shore, where a range of barren hills, called the Mealy mountains, rise abruptly from 800 to 1200 feet above the bay.

Three large rivers flow into the head of the inlet. The Northwest river comes in on the north side, some 15 miles from the head of the bay. At its mouth this stream is upwards of 100 yards wide, with a strong current and a deep channel. It flows through a long lake near its entrance to the inlet, and rises in Lake Michikamau, some 250 miles to the north-west. Almost opposite the mouth of the Northwest river, another large stream empties into the inlet from the south-west. It is called the Kenamau river, and flows down from the tableland with continuous shallow rapids, that render it quite unnavigable. The Hamilton river empties into the head of the inlet, and occupies a wide valley, apparently the continuation of that of the bay. This is the most important and largest river of the eastern watershed of Labrador. Its drainage basin extends westward, almost halfway across the peninsula, and has a breadth of upwards of 200 miles.

Owing to the great difference in physical character, the river is naturally divided into two parts at the Grand falls, some 250 miles inland.

The lower portion flows in a distinct valley, cut out of gneisses and granites, where the river, at present, is from 500 to 1000 feet below the general level of the surrounding country. Above the Grand falls the

river flows on the surface of the tableland, and there descends into the valley with a sudden drop. From its mouth to the junction of the Minipi river, 80 miles up, the general course of the river is west-south-west. The hills forming the walls of the valley are from 3 to 4 miles apart, for 60 miles from its mouth.

The valley is partly filled with sandy drift, out of which the river has cut a shallow channel nearly a mile across, except at the Muskrat falls, 27 miles above its mouth, and at two rapids further up. The Muskrat falls have the form of a low chute, a quarter of a mile long, with a total drop of 70 feet. This is the only place, below the Grand falls, where rock in place is seen in the river-bottom. The banks of the stream are always sandy, and are often high and steep, with terraces cut into the drift at different levels, up to 200 feet above that of the river at present.

The trees along this part of the river-valley are large for a situation so far north. White spruce 2 feet in diameter and 70 feet tall are not uncommon; and black spruce trees, though not so large, are of sufficient size to afford good commercial timber. Balsam spruce, white birch, and both aspen and balsam poplar, are all common, and grow to 15 inches in diameter.

At the Gull rapids, 60 miles up, the valley is less than half a mile across, with almost perpendicular walls that rise from 400 to 800 feet directly from the river. The channel varies from 100 to 400 yards in width, and for 19 miles is occupied by continuous rapids.

The Minipi river pours in with heavy rapids, through a narrow valley at the head of this stretch. It discharges a considerable volume of water, gathered from a number of large lakes on the tableland to the south-west of its mouth.

From the Minipi river to the Grand falls the general course of the main valley is west-north-west. Above this branch the valley of the main stream again opens up, and the hills, for upwards of 25 miles, are from 1 to 2 miles apart. The channel along this part varies in width from a quarter to half a mile, and only in a few places is the stream broken by small rapids.

The surrounding country, from near the Gull rapids to beyond the Grand falls, has been traversed by numerous fires, the last of which burned throughout the summer of 1893, sweeping away the forests in the valley and on the tableland on both sides, and leaving only bare sand and rock, or small second-growth trees.

Beyond this stretch of quiet water the hills once more approach, narrowing the valley to less than a mile. Several sharp bends in the direction of the valley occur in the next 30 miles, where in places it is less than a quarter of a mile across, with its rocky walls rising directly from the narrow shores. The hills are nearly all bare and rocky; and at the upper end, where the river flows out of Lake Winokapau, they

rise in vertical cliffs 1000 feet above the water. As the river is ascended it becomes narrower, with increasing current, so that the last 6 miles to the lake is a continuous rapid, with three heavy pitches.

Lake Winokapanu fills an expansion of the river-valley from 1 to 2 miles wide and 35 miles long. The water of the lake is remarkably deep, and two soundings, taken about halfway up in the middle, gave 406 feet and 417 feet. On account of the thickness of the ice (4 feet 9 inches), no other soundings were made. This great depth is taken to represent the level of the valley previous to the Glacial period, during which period the river-valley was everywhere blocked with drift, except along the portion occupied by the lake, where, from some cause unknown, no deposit of glacial drift was laid down. At the head of the lake a little branch, called the Elizabeth river, joins from the westward. At its mouth a small Hudson's Bay post was formerly situated. Above the lake, for 35 miles, to the foot of the portage route past the Grand falls, the character of the river and valley remain unchanged. The latter has a number of gentle bends, and varies from half a mile to a mile in width, with the river-channel filling about half of its bottom, where the river flows between banks of drift with a steady current of about 3 miles an hour.

Above the portage the valley quickly narrows to less than a quarter of a mile, and is full of sharp bends. Down it the river rushes in a continuous rapid for 9 miles, from the mouth of Bodwain cañon, where the main stream pours into the valley from a narrow gorge on its north side. The valley above the cañon continues on towards the north-west.

Above the forks it is occupied by a stream having less than one quarter the volume of the river that issues from the gorge. The smaller stream flows from the westward, out of Lake Ossokmanowan, which also has another outlet into the main river. Eight miles in a straight line north-north-west of the mouth of the cañon, the main branch of the Hamilton river issues from a small lake expansion, almost on a level with the surface of the surrounding tableland, and commences the greatest and wildest descent of any river in Eastern America. The lake is 1660 feet above sea-level, and the valley at the mouth of the gorge is 900 feet above the sea; consequently, in 12 miles the river falls 760 feet.

The volume of water passing down is great, and is estimated to average 50,000 cubic feet per second. From the lake, for 4 miles, the river rushes along in a shallow channel, filled with boulders that break the water into heavy rapids, with a total fall of 95 feet. In the next mile it descends 110 feet, in a narrow trough cut out of solid granite, with steep sloping walls, down which the river pours in a tremendous rapid. As it descends, its width decreases from 150 to less than 50 yards; and in the last 300 yards, where the grade is very steep, the waters rush along with a deafening roar, in a white swirling mass, thrown into great long

waves that are at least 20 feet from crest to hollow. With a final huge pent-up wave, the great mass of water is shot down a steep incline of rock for 100 feet, where it breaks into a mass of foam, and then falls freely into a circular basin, 300 feet below the crest of the fall. The momentum acquired in the descent of the incline is sufficient to carry the water well out from the foot of the vertical wall of rock at the bottom. The Indians believe that the space so made is the abode of the spirits of two Indian maidens, who were accidentally carried over the falls. On this account, or more probably because of the awe inspired by the grandeur of the surroundings, and the enormous power displayed in the rush of water and the thunderous roar, the Indians who hunt in the vicinity cannot be induced to visit either the falls or the cañon below.

The basin into which the river precipitates itself is nearly circular, and about 200 yards in diameter. It is surrounded by perpendicular rocky walls 500 feet high, except where the river enters and flows out. At the time of our first visit (May 1), these vertical walls were completely hidden under a thick coating of ice, formed from the condensation of the great column of spray that rises high above the level of the top of the falls. The lower half of this ice-covering was in the form of gigantic icicles, presenting in the sunlight a beautiful display of iridescent colour, through shades of blue, green, and yellow, that contrasted strongly with the dead white of the upper portion. At the head of the falls a small bottle was found containing records of the visits of Messrs. Cary and Cole, and Bryant and Kenaston, who ascended the river in 1891.

The river leaves the basin by a narrow cañon at right angles to the falls. This cañon is less than 100 yards wide at the top, and has almost vertical rocky walls. It runs in a zigzag manner for 6 miles, until it ends in the main valley. Along its bottom, 500 feet below the surface of the surrounding country, the river, less than 100 feet wide, rushes with a continuous rapid, and falls 260 feet while passing through the cañon.

The portage route past the falls leaves the valley on its north side, and in a quarter of a mile rises 700 feet, where it ascends the steep wall of the valley. It then continues 2 miles, to the first of a chain of small lakes, connected by twelve portages, that lead to the lake expansion of the river above the falls. Great difficulty was experienced in the ascent of the steep hill with the provisions, sleds, canoes, and outfit, as at the time it was covered with ice and slush, rendering it, in places, almost impassable.

Sled-travel was abandoned on May 19, owing to the rotten state of the ice on the smaller lakes; and, having established a camp on the banks of one of them, we waited there until the 27th, when work was resumed in canoes. This at first was exceedingly dangerous in the main river,

where the thick blocks of ice from the lakes above ran freely until June 5. Besides the large blocks, the water was covered with sharp needles of ice from 2 to 3 feet long, which, unless great care was taken, would have quickly penetrated our thin canoes advancing against the strong current. The ice was jammed in several rapids, past which portages were made. In two places the ice moved down the rapid while we were making the portage, and we had a lively time getting canoes and outfit away from danger over the moving mass.

Our ascent of the river at this time was due to an appointment made with an Indian, whom we had previously met, and who had agreed to meet us at the second lake of the river on June 1.

Above the Grand falls the character of the river changes completely; it no longer has a distinct valley cut deep into the surrounding country, but flows nearly on a level with the surface of the plateau, where it spreads out and fills the depressions between the low ridges of rock or drift that are arranged in echelon over the country. In passing around the ridges, the river is often broken into several channels by large islands, and in other places, where the valleys are wide, it forms long island-covered lakes, with deep narrow bays. The river is so broken into channels and lakes, that it is next to impossible to follow the main channel without a guide.

The current no longer flows steadily, but alternates between short rapids and long lake stretches. The general course of the stream is parallel to the ridges and the glacial striæ (west-north-west) from the falls to Lake Petitsickapau, 100 miles above. All these features give to the upper portion of the river an aspect of newness, and show its present course and conditions to have been determined by the post-Glacial configuration of the tableland. From the end of the portage-route to Sandgirt lake, 45 miles above, the river passes through two small lakes, connected by stretches of rapids, where many islands divide it into a labyrinth of channels. The surrounding country has been largely burnt over, leaving many barren areas. The standing trees are very small and stunted, and, except close to the river, grow in open glades. Black spruce everywhere predominates, with larch balsam spruce, and white birch growing in favourable places.

Sandgirt lake owes its importance to its situation, rather than to its size, as it is only 12 miles long and 8 miles wide. The river here divides into two main branches: the Ashwanipi branch, flowing in from the north-west; and the Attikonak branch, from the south. Beside the routes by these streams, another from Lake Michikamau to the north-east centres here. A number of families of Indians congregate here in the spring, to await the breaking up of the ice, after which they descend in a body to Mingan, on the Gulf of St. Lawrence, where they trade their furs.

Owing to the necessity of making two loads against the strong

spring freshets, our progress to this place was slow, and we did not arrive until June 15. On account of its favourable situation for exploration in various directions, a cache was constructed on one of the islands in the lake, where all extra supplies and outfit were stored.

The survey was then carried up the Ashwanipi branch, for the accomplishment of which a month's time and provisions were allowed. This stream is the larger of the two branches, and varies from 200 to 500 yards in width, as it flows swiftly along for 30 miles from where it issues out of Birch lake. The surrounding country is very similar to that already described. From Birch lake upwards, the aspect of the country alters, on account of a change in the underlying rocks.

The iron-bearing series, previously met with along the Koksoak river, now replace the gneisses, and continue westward beyond the bounds of this exploration. Sharp parallel ridges of rock, with irregular outlines, now rise from 300 to 700 feet above the general level, and are separated from one another by wide, flat valleys. The upper parts of these ridges are treeless, and are covered only in part with white lichens or small shrubs, including the northern cranberry (*Vaccinium vitis-idaea*), which grows everywhere in profusion through the barrens. It is an important article of food, owing to the lasting quality of its fruit, and its improvement by frost, so that it continues excellent until late in the summer.

From the summit of any ridge, a fine view of the surrounding country is obtained. The wide valleys between the ridges are almost wholly occupied by long irregular lakes, covered with islands, and broken into deep bays by low ridges of drift. These lakes are joined together by a network of streams, so that canoe-travel is possible in any direction when the country is known. Otherwise much time is lost going up the wrong bays and channels, as was the case with ourselves, when looking for the main stream in the lakes immediately above Birch lake, where ten days were spent in useless search before the stream was finally found.

The change of rock is accompanied by a marked improvement in the size of the trees, due to the increased richness of the soil. White spruce 30 inches in diameter and 40 feet tall are common in the river-valley, where they grow along with black spruce 2 feet in diameter. Balsam spruce and larch are also abundant, together with white birch and a few clumps of balsam poplar. The extreme cold of winter, and the cold northern winds at all seasons, have greatly stunted the growth of the trees, and their height does not correspond with their girth.

Among the small fruits found in this portion of the interior may be mentioned two species of red currants (*Ribes rubrum* and *R. prostratum*) abundant everywhere; the common raspberry (*Rubus strigosus*) and the arctic raspberry (*Rubus Arcticus*); the wild strawberry (*Fragaria Virginiana*) is not plentiful; two kinds of blueberries (*Vaccinium uliginosum*

and *V. Pennsylvanicum*) grow in profusion everywhere; the wild cherry (*Prunus Pennsylvanicus*) is commonly found growing on old burnt land, along with two varieties of *Amalanchier Canadensis*, which also grow in the wooded areas.

Above Birch lake, which is 10 miles long, the river is divided into three channels, that unite again 12 miles above, in the next or Dyke lake. This is the lowest of a network of large lakes connected by short rapids. At its north-west end, 20 miles above its outlets, a small, deep narrows, mistaken by us for the main stream, leads into Lake Petitsick-apau, where the Hudson's Bay Company formerly had an outpost called Fort Nascaupi. The ruins are still to be seen on the shore of the lake. This lake is 25 miles long, and 10 miles across in its widest part. It is exceedingly shallow, and is divided into four deep bays at the north-west end. Only a narrow ridge separates it from Attikamagen lake, at the head of the George river, emptying into Ungava Bay.

The inlet of the main stream is on the south side of Dyke lake, near its north-west end, where a short rapid connects it with the next long lake above, whose inlet is at its south end, opposite the outlet.

There is here another short and strong rapid connecting with the next lake. The inlet of this lake is 15 miles to the southward, where another short rapid from the west leads to another long lake, separated from the last only by a narrow ridge. This lake was followed in a north-west direction for 12 miles to its end, where the river enters, after passing down 5 miles of rapids from Menihék lake. This portion of the route, like the description of it, was very bewildering, especially as we were always looking for the river in the northern bays of the lakes; and not until they were thoroughly explored did we think of searching in the opposite direction, or almost doubling on our former course.

Menihék lake is another of these long narrow lakes, and varies from 1 to 2 miles in width. From its outlet due south to where the river flows in its length is 50 miles. A high barren ridge of hills bounds its west side.

The southern end of the lake marks the change from the iron-bearing series of rocks to the gneisses, and the country surrounding the river above it again corresponds to that below Birch lake.

The river for 24 miles, to where the survey ended, has a strong current, with frequent rapids, being there 75 yards wide and 6 feet deep. About 50 miles above the end of the exploration, it flows out of Lake Ashwanipi, a large irregular body of water, upwards of 50 miles long, situated just north of the watershed dividing the Hamilton river from the streams flowing southward into the Gulf of St. Lawrence.

The survey was not carried to the head of this lake, owing to the time lost in search of the river below, and the consequent lack of both time and provisions to complete the work in such a large irregular lake

as Ashwanipi was known to be. After marking the end of survey, we returned down-stream and reached Sandgirt lake on July 18. Before leaving this part of the river, attention must be again drawn to the immense amount of rich iron ore seen about the shores of the lakes, which can only be estimated by millions of tons.

Another important item of unexhaustible wealth is that of the fisheries of the lakes and river, and the remarks on this subject apply to all the waters of the interior of Labrador. The river stretches swarm with brook trout, from 3 to 6 lbs. in weight, and afford as fine fishing as can be found in Canada. Along with the trout are numbers of land-locked salmon, from 1 to 5 lbs. in weight, together with large white fish, pike, and two species of carp. In the lakes all these kinds are taken, along with lake trout up to 40 lbs. in weight, and, if the Indians are to be believed, often to twice that weight.

The next exploration from Sandgirt lake was in a north-east direction, 65 miles to Lake Michikamau. We started on this trip with supplies for twenty days; but, owing to favourable weather, we returned on July 30.

The route to Michikamau leaves Sandgirt Lake by its northern discharge, which is descended a few miles to Lob-stick lake, a large body of water with several deep bays. Passing to its eastern end, a small stream was ascended a short distance into a large lake dotted over with myriads of small rocky islands, with a second similar lake beyond, from which a portage leads to the water flowing into Lake Michikamau.

As an example of the intimate connection between the head-waters of the various rivers of Central Labrador, it may be mentioned that the valley along which the portage passes is occupied by a small lake, that discharges either northward into Lake Michikamau, or southward into the Hamilton river, according to the direction of the wind. When Lake Michikamau is above its normal level, in the spring, a large stream carries part of the overflow into the Hamilton river by this valley, and no portage is then necessary to pass from the Hamilton to the Northwest river.

From the portage, the route passes east for 15 miles; the first half is through a lake, followed by a short stretch of river, into a long narrow bay of Lake Michikamau. This, the "Grand Lake" of the Indians of Eastern Labrador, is well worthy of its name. It is 70 miles long, and 20 miles across in the widest part, with an average width of 10 miles. Its longest axis extends from south-east to north-west. While Michikamau is considerably shorter than Mistassini, its expanse is not dwarfed by large islands and long points like the latter; and the high rocky hills that surround it add much to the beauty of the lake, and contrast favourably with the low shore-line of Mistassini.

The country about the lake and along the route is very similar in character to that already described, except that the ridges of drift are

wanting over many areas, and, in consequence, the low rounded hills of gneiss are more marked.

Lake Michikamau is on the limits of the continuous forest belt. To the northward of it, stunted spruce and larch grow only in protected valleys, around the margin of lakes and watercourses. The remainder of the surface is either bare rock strewn with boulders, or else covered with dwarfed willows and shrubs, or white lichens, giving the landscape a naked and uninviting appearance.

The Northwest river flows out of Lake Michikamau on its north side, about 30 miles from its north-west end.

Returning to Sandgirt lake, the cache was emptied, and a final start was made on August 1, up the Attikonak branch. This stream flows out of a large lake of the same name, some 75 miles to the south-south-east of where it joins the main stream. Its volume, where it enters Sandgirt lake, is about one-half that of the Ashwanipi branch at the same place. The river has a strong current, with numerous rapids, for 11 miles, to its outlet from a long narrow body of water 45 miles long, called Lake Ossokmanowan. This lake has a second outlet on the east side, whose volume is about equal to the branch ascended. The second outlet passes eastward down the main valley, and joins the main stream at the mouth of Bodwoin cañon. South of Lake Ossokmanowan for 26 miles, to Lake Attikonak, the river flows with rapid current, except where it passes 5 miles through a lake.

Lake Attikonak is another of those large, irregular bodies of water that cover more than one-third of the surface of the interior tableland. Its appearance is dwarfed by the number of islands that dot its surface in all directions. From its outlet to the head of its south-east bay, the distance is 36 miles. A short portage route leads from this bay to the Romaine river, which flows southward into the Gulf of St. Lawrence. Where the route joins it, this stream is less than 100 yards wide; and a short distance below enters, and for 35 miles passes through, four lakes, connected by short rapids. These are called the Burnt lakes, and derive their name from the total destruction by fire of the forests surrounding them. From Sandgirt lake to the outlet of the lowest Burnt lake, the country is low and rolling like that already described.

Below the lakes the river assumes its proper character, and flows swiftly down a valley from half a mile to two miles wide, with steep granite walls that rise from 300 to 800 feet above the surface of the stream. The valley has been partly filled with drift, out of which the river-channel is cut, the former levels of the river being marked by the terraces that are now seen at different elevations up to 100 feet above the surface of the water.

The river was followed downward 45 miles, to where it takes a sudden bend to the eastward, and soon passes into a narrow gorge between high rugged hills of gabbro. In this gorge it falls with continuous

heavy rapids, and is quite impassable with canoes. If such were not the case, the Indians would never use the portage route that leads from the Romaine to the St. John river. This route follows a number of small lakes and streams in deep, narrow valleys between rugged hills of gabbro, that rise nearly 3000 feet above sea-level, or considerably higher than the general level of the interior tableland. The total length of the route is 65 miles, with thirty-one portages, in all 19½ miles long, and together forming the longest and worst portage route in any part of Eastern America.

Before reaching the St. John river, the general level of the country falls more than 1500 feet. This river has a valley from half a mile to two miles wide, with steep rocky walls. Down the valley the river flows rapidly as it winds from side to side, and is only broken by one small fall until it empties into the Gulf of St. Lawrence, about 40 miles below where the portage route joins it.

We arrived at the mouth of the river on August 22, after an absence of nearly six months from any base of supplies, during which 906 miles of micrometer survey and 280 miles of track surveys were made. These surveys have since been mapped, and the manner in which they tie with previous surveys reflect great credit on Mr. Eaton, to whose careful work the accuracy is due.

The practical and scientific results of the exploration, beyond the additions to the geographical knowledge, may be summed up as follows: All the exposures of rock along the various routes were examined, and a large quantity of information was obtained in regard to the relations of the various rocks that make up the Archean complex, which occupies over nine-tenths of the area of Labrador. A great area of supposed Cambrian rock, which can be correlated with the iron-bearing rocks of Lake Superior, was discovered extending from latitude 50° north-westward to, probably, beyond the west side of Ungava Bay. Many interesting facts were gathered in regard to the ancient configuration of this great area, along with others relating to the glacial phenomena. Among these may be mentioned the evidence of a confluent ice-cap over Labrador, except on the highlands along its north-east coast, and that the movement of the ice was everywhere outwards from the central interior towards the coast.

Large collections of rocks, minerals, plants, birds, birds'-eggs, and insects were brought home. These, in conjunction with the notes taken, will add greatly to the knowledge of the natural history, and the distribution of life, animals, and plants, in these regions.

Meteorological observations were regularly kept, together with notes on the thickness of ice, snowfall, and other subjects bearing upon the climate. About 250 photographs were taken to show the characteristic features of the country passed through, and other subjects of interest.

The elevations of different points along the routes have been partly

worked out from barometrical readings taken in conjunction with station barometers at Northwest river and on the island of Anticosti. The elevations already determined are marked in blue on the accompanying map.

A more detailed report on the country and its resources is being prepared for the Geological Survey of Canada, along with a map of the Labrador Peninsula, on a scale of 25 miles to an inch, which will allow the geographical features to be shown with greater completeness than is possible on the map to accompany this paper.

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